Research Articles

Lifestyle and Clinical Health Behaviors and PSA Tests

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ABSTRACT

This study assessed the association of lifestyle and clinical health behaviors with prostate specific antigen (PSA) tests. The study used cross-sectional data from the 2002 Behavioral Risk Factor Surveillance System (BRFSS). We used Stata 8.0 to take into account the complex sample design in analyses. Both lifestyle and clinical health behaviors were associated with PSA use. Life style behaviors associated with PSA use include not smoking, moderate or no drinking, regular seatbelt use, and leisure physical activity. Clinical health behaviors associated with PSA use were influenza vaccines and colorectal cancer screening. The strongest associations were with colorectal cancer screening and access to care. The strong alignment of PSA testing with positive health behaviors suggests men view PSA tests as protective. This perspective may complicate health education messages to support informed decision making about prostate cancer screening.

Prostate cancer is the second leading cancer diagnosed in men in the United States after skin cancer and is the second leading cause of cancer-related death in men.[1] Professional uncertainty about the advisability of mass prostate cancer screening is expressed in contradictory and controversial guidelines. For example, the American Cancer Society[2] recommends that both the PSA and digital rectal exam (DRE) should be offered annually, beginning at age 50 to men who have at least a 10 year life expectancy and at earlier ages to men at high risk (African American men and those with first-degree relatives with a history of prostate cancer). At the other end, the U.S. Preventive Task Force has concluded that there is insufficient evidence of reduced mortality and morbidity to support recommendation of prostate cancer screening, though there is evidence that the PSA detect early cancers.[3] Despite professional disagreement about whether to recommend PSA screening, there is accord about recommending the provision of information to support patients in making informed decisions based on their own values about whether to seek screening.[4-6] Because of the uncertainty about prostate cancer screening, it is important to understand what factors influence PSA use.

One potential clue is in its association with other health-related behaviors. We classify health behaviors as related to lifestyle or clinical. Lifestyle health behaviors are individual behaviors that support health through activities like regular exercise, eating nutritious foods or avoiding tobacco. Clinical health behaviors include seeking screening for serious diseases, immunizations to prevent disease, or obtaining counseling to support health. Some studies have examined the association of multiple *lifestyle* health behaviors to target health promotion interventions to behaviorally and motivationally distinct groups.[7-10] Pronk and associates[10] have suggested that these analyses can spark "person-centered health improvement" efforts.

Fewer studies have linked clinically provided health behaviors. For example, smokers and those who drink alcoholic beverages are less likely to have breast and cervical cancer screening.[11-14] Lifestyle and clinical health behaviors may have a common link through beliefs about health protection, but

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they also have distinct influences. Lifestyle health behaviors are performed more frequently and clinical health behaviors are influenced by physician-patient interactions and access to health services.[8]

The objective of this article is to test the association of lifestyle and clinical health behaviors on the use of PSA tests for prostate cancer screening while controlling for variables associated with access to health care.

FACTORS ASSOCIATED WITH PSA USE IN POPULATION-BASED STUDIES

Prostate cancer screening calls for the use of both DRE and the blood-based PSA tests. However, we have limited this study to PSA because the data source for this study does not ask about DRE. We reviewed seven studies of PSA use, which employed probability based methods to obtain a representative sample.[15-21] Studies were either national or of states; their sample sizes ranged from 239 to 4,339 men. The association of health behaviors with PSA use was not their focus; however, three studies included lifestyle health behaviors,[16,18,19] three included clinical health behaviors,[15,17,19] and two had no health behaviors.[20,21]

In a survey of 332 men in Washington State, PSA use was marginally related to physical activity, and associated with lower fat intake and higher fruit and vegetable consumption, but not related to smoking.[16] Merrill's[18] analysis of survey data from 1,293 Utah men aged 40 or older found no relationship between PSA use and exercise or fruit and vegetable consumption. A recent study using data from the National Health Interview Survey found no relation with alcohol consumption, but lower PSA use among current smokers.[19]

With respect to clinically mediated health behaviors, the picture has frequently been negative. PSA use was not associated with either proctoscopic or regular physical examinations in a sample of Texas men.[15] Similarly, no association between PSA use and routine health exams was found in men of New Mexico.[17] However, Ross et al.[19] reported a positive bivariate association with colorectal cancer screening.

This review did find support for the importance of access to health care and physician's recommendations for predicting PSA use.[18,19] Education, a variable associated with knowledge and with other social resources, was identified as important by several researchers.[15,16,18-20] Race and ethnicity were influential in some studies,[20,21] but not in others.[19]

In sum, while we expected PSA use to be related to other health behaviors, the literature review found uneven support for relationships between lifestyle health behaviors and PSA testing, that is, support was found for a few lifestyle behaviors in some but not all studies. There were few studies that assessed the association of clinical health behaviors and PSA use.

METHODS

The Behavioral Risk Factor Surveillance System (BRFSS) surveys are conducted by states under the sponsorship of the Centers for Disease Control and Prevention (CDC).[22,23] State health departments collect data, by telephone interviews of adults, on preventive health practices and risk behaviors that are linked to chronic diseases, injuries, and infectious diseases. The study data were from the 2002 survey for the 50 states and the District of Columbia. The public use data files had no personal identifiers. The study was approved by the Committee for Protection of Human Subjects of The University of Texas Health Science Center-Houston.

The cooperation and response rates of the BRFSS vary by state.[24] The cooperation rate or the percentage of identified potential respondents who complete an interview ranged from 62.5% to 99.8%, with a median value of 76.7%. The Council of American Survey Research Organizations (CASRO) response rate for the states ranged from 42.2%–80.6%, with a median of 58.3%. The CASRO response rate assumes that unresolved phone calls have the same proportion of eligible respondents as resolved calls.

Measurement

PSA use. The dependent variable, current PSA use, was defined as having had a PSA test within the last year. It was based on two questions: "A Prostate-Specific Antigen test, also called a PSA test, is a blood test used to check men for prostate cancer. Have you ever had a PSA test?"; and "How long has it been since you had your last PSA test?" No questions were asked about receipt of the digital rectal exam.

Health behaviors. Lifestyle behaviors included exercise, smoking status, alcohol consumption, and seatbelt use. Exercise was a dichotomous measure based on the question: "During the past month, other than your regular job, did you participate in any physical activities or exercises such as running, calisthenics, golf, gardening, or walking for exercise?" Smoking status was classified as current smokers (have smoked at least 100 cigarettes and smoke now), former smokers (have smoked at least 100 cigarettes and do not smoke now), and never smoked (have not smoked at least 100 cigarettes in his lifetime). Alcohol consumption was defined as the average number of drinks consumed on the days that men drank (drinks per session) classified as one or two drinks, three or more drinks, and no drinks which also includes men who do not drink alcohol. The frequency of seatbelt use was categorized as always use a seatbelt or sometimes or never use a seatbelt.

Clinical behaviors included influenza immunization, use of sigmoidoscopy or colonoscopy, and blood stool test use. Receipt of influenza immunization was based on the question, "During the past 12 months, have you had a flu shot?" Being current on sigmoidoscopy or colonoscopy was based on two questions: "Sigmoidoscopy and colonoscopy are exams in which a tube is inserted in the rectum to view the bowel for signs of cancer or other health problems. Have you ever had either of these exams?" and "How long has it been since you had your last sigmoidoscopy or colonoscopy?" Men were classified as current (within the past five years), not current (more than five years ago), or never had the test. Use of fecal occult blood test (FOBT) or a blood stool test was assessed

with two questions: "A blood stool test is a test that may use a special kit at home to determine whether the stool contains blood. Have you ever had this test using a home kit?"; and "How long has it been since you had your last blood stool test using a home kit?" Men were classified as current (within the past two years), not current (more than two years ago), or never had the test. For the multivariable analyses, we created a variable categorizing current use of any colorectal cancer screening method. Men were classified as current if they had sigmoidoscopy or colonoscopy within five years or FOBT within two years. While the screening interval for colonoscopy may extend to 10 years, we chose the five year interval to classify current screening status because we cannot distinguish which testing method was used.

Access and socio-demographic variables. It is important to control for access to health care since PSA tests are commonly conducted in clinical settings. Such variables are also partial proxies for variables that directly characterize the provider-patient relationship, which are not available in the BRFSS. Two dichotomous access variables were used: having health insurance and having a personal physician. Socio-demographic variables included were age, race/ethnicity and education. Age was stratified by 10-year age groupings and age 70 or older (50-59, 60-69, & 70+). Race/ethnicity was classified as African American, non-Hispanic; White, non-Hispanic; Hispanic (any race); and other non-Hispanic. Education was classified as having not completed high school, high school graduate, and having been educated beyond high school.

Population

Of the 41,561 men aged 50 or older, 39,051 had data to characterize current PSA use. We excluded 2,486 men because they reported prostate cancer or lacked data for history of prostate cancer. The final sample size was 36,565 men.

Analysis

The volume of missing data on covariates ranged from .06% to 1.42%. Multivariable analyses were conducted with complete cases. The analyses used Stata 8.0 survey procedures to take account of the complex sample design with unequal probability of selection and stratification (Stata Corp, College Station, TX). Tables display unweighted frequencies and weighted percentages. In cross tabulations, the presence of relationship was tested with a variant of the Pearson chi-square test with correction for the survey design. The logistic regression procedures for survey data were used to assess the association of socio-demographic, access, clinical behaviors and lifestyle health behaviors on current use of PSA tests. These results are presented as adjusted odds ratios and 99% confidence intervals. Reported p-values are based on two sided tests; in view of the large sample size, we regard a p-value less than .01 as significant. The Wald chi-square was used to assess the overall significance of each factor such as race/ethnicity or health insurance.

RESULTS

The sample is described in Table 1. Fifty-eight percent had education beyond high school. Nearly 80% were non-Hispanic White, with approximately 7% non-Hispanic black or Hispanic (any race). Most reported some form of health insurance and a personal physician. With respect to lifestyle behaviors, three-fourths reported leisure physical activity. Current smokers made up 19% of the sample, and about 35% were former smokers. Forty-three percent reported one or two drinks per session, while 12% reported three or more drinks. Seventy-eight percent said they always wear their seatbelt. Of clinical health behaviors, more than half had no prior sigmoidoscopy or colonoscopy, while 40% have had this test within the past five years. Thirty percent reported a blood stool test in the past two years, and 57% had never used this test. Less than half had a flu shot in the past year.

Twenty-six percent said they had not had a PSA test (data not shown in a table). Testing in the past year (current PSA) was reported by 54% of men, 12% were tested one to two years prior to the interview, and 8% more than two years before the survey.

Tables 2 and 3 summarize the cross tabulation of current PSA use with socio-demographic, access, and health behaviors. In these bivariate analyses, each variable was significantly related to current PSA use. Age was positively related to PSA use. Non-Hispanic Whites, followed narrowly by African Americans, had the highest prevalence of testing compared to Hispanics and non-Hispanics of other races. Education was positively associated with use, as were access indicators, source of care and health insurance. Clinical health behaviors were strongly associated with PSA use. Men with flu shots or current in one of the colorectal cancer modalities had screening rates at least 20% higher than men who had not been screened for colorectal cancer or who did not have a flu shot.

The relationships of lifestyle health behaviors with PSA use were less striking, although statistically significant. Current smokers had lower use of PSA tests. Men with leisure physical activity were more likely to have current PSA test. Men who always use a seatbelt were somewhat more likely to have a current PSA test. The patterns with drinking are interesting. Men who reported three or more drinks a day were less likely to have a PSA test, while those with one or two drinks were most likely to be tested, and those with no drinks were intermediate.

Multivariate analysis

Table 4 presents adjusted odds ratios and 99% confidence intervals for current PSA test use with socio-demographic and access factors, lifestyle health behaviors, and clinical health behaviors. Because of the large sample size, achievement of statistical significance was more likely than with a smaller sample. Thus, we will focus more attention on the *size* of the relationship depicted in the adjusted odds ratios. All variables were significantly related to current PSA use except for race/ethnicity. The clinical health behaviors had strong relationships with PSA use: men current in colorectal cancer screening were nearly three times more likely to have PSA tests and having a flu shot was also positively associ-

Table 1. Sample Description[a]

	%	n		%	n
Socio-demographic			Smoking Status		
Age			Current	19.0	6,870
50–59	46.9	16,447	Former	46.4	17,106
60–69	29.3	10,741	Never	34.6	12,472
70+	23.8	9,377	Total		36,448
Total		36,565	Seatbelt use		
Race/Ethnicity			Always	78.0	26,124
White	79.8	30,873	At times or never	22.0	9,968
African American	7.1	1,854	Total		36,092
Hispanic	7.4	1,301	Drinks per session		
Other	5.7	2,091	One or two	43.4	15,667
Total		36,119	Three or more	12.4	4,351
Education			Total		36,188
< High school	13.8	4,697	**Clinical Health Behaviors**		
High school graduate	28.1	10,566	Sigmoidoscopy/colonoscopy		
> High school	58.1	21,229	Within past 5 years	40.5	14,323
Total		36,492	More than 5 years	7.3	2,717
Access			Never	52.2	19,007
Health Insurance			Total		36,077
Yes	91.4	33,426	Blood stool test		
No	8.6	3,096	Within past 2 years	30.3	11,180
Total		36,522	More than 2 years	12.8	4,618
Source of Care			Never	56.9	20,327
Yes	86.1	31,636	Total		36,139
No	13.9	4,855	Flu shot in past 12 months		
Total		36,491	Yes	46.3	17,853
Lifestyle Behaviors			No	53.7	18,644
Any Leisure Physical Activity			Total		36,497
Yes	74.6	27,254			
No	25.4	9,288			
Total		36,542			

[a]Weighted % and non-weighted n

ated with current PSA use. Of the lifestyle behaviors, smoking status was mostly strongly related to PSA testing, with current smokers being least likely to have PSA tests.

Access variables, particularly regular source of care were also influential. Men with a regular source of care were 2.5 times more likely to have PSA testing. Race/ethnicity was not associated with PSA use when controlling for other variables.

DISCUSSION

PSA use is relatively wide spread with more than half of U.S. men aged 50 or older reporting a test within the past year. The relationships with clinical health behaviors, particularly colorectal cancer screening, were stronger than for lifestyle health behaviors. However multiple lifestyle behaviors including not smoking, moderate drinking, physical activity, and regular use of seatbelts were also related to PSA use. Prior studies have not focused on the association of the PSA with a wide array of health behaviors. Prior research has shown higher PSA use by non-smokers;[19] however, this study identified additional related lifestyle health behaviors.

The strong relationship with other clinically mediated health behaviors has not been found in prior research, with the exception of inconsistent results in relation to colorectal cancer screening.[15,19] However, both immunization for influenza and colorectal cancer screening were associated with PSA use.

Access to health care and continuity of health care are important factors in obtaining clinical health behaviors, including PSA tests.[18,19] Our results are consistent, finding PSA use positively associated with health insurance and having a usual source of care. In addition, education, both an indicator of socioeconomic resources and of the ability to make use of information and obtain

desired services, was associated with PSA use.[18-20]

The higher mortality for prostate cancer in African American men and greater identification of this cancer in later stages in Hispanic and African American men support the importance of examining disparities in PSA use.[1,25-28] Bivariate analyses distinguished higher levels of use by non-Hispanic Whites and African Americans than by Non-Hispanic others and Hispanics. However, in multivariable analyses, race/ethnicity was not associated with PSA use when controlling for socio-demographic and access variables (data not shown). This suggests that education and access to health care are influential in observed race/ethnicity differences in PSA tests. The socio-demographic and access variables with greatest race differences were education, health insurance and having a regular source of health care.

It is unfortunate that the BRFSS does not ask about physician recommendations for the PSA and other screening tests. Physician recommendations have been identified as strongly influential in several studies.[15,21] It is possible that a portion of the association between PSA use and access and clinical health behaviors would be partially accounted for by physician recommendations.

This study has both strengths and limitations. Its strengths include the use of nationally representative and systematically collected data. The large sample size provides sufficient power to assess potential differences associated with smaller subgroups such as ethnic minorities. The BRFSS survey contains information on a wide range of lifestyle and clinical health behaviors and is well-suited to this research question. Finally, the analysis was conducted using statistical procedures to take account of the complex sampling design of the survey. Less positively, as a telephone survey, the BRFSS has limitations in coverage of households without telephones. There also are limitations related to the self-report of PSA use. Clinical studies have shown that men make errors in both under- and over-reporting of PSA testing.[29-31]

Table 2. Current PSA Test Use by Sociodemographic and Access Variables

	%	χ^2	df	Probability
Socio-demographic				
Age		98.79	2	0.0000
50–59	47.0			
60–69	58.0			
70+	61.6			
Race/Ethnicity		11.91	3	0.0000
White	55.3			
African American	52.3			
Hispanic	44.4			
Other	44.7			
Education		59.58	2	0.0000
< High school	42.0			
High school graduate	51.4			
> High school	57.6			
Access				
Health Insurance		213.45	1	0.0000
Yes	56.0			
No	29.4			
Source of Care		464.41	1	0.0000
Yes	58.3			
No	25.5			

Health education about prostate cancer screening is complex. Professional guidelines are contradictory and controversial. PSA tests are as good as many screening tests in identifying early cancers, but there is not yet evidence that early detection is associated with lower mortality or morbidity.[3] Current recommendations call for health practitioners to support informed decision making so that men can consider advantages and disadvantages of screening in light of their preferences. The association between PSA use and a wide array of positive health behaviors suggests that PSA testing is aligned with men's views of health protection. This alignment may complicate efforts to support informed decision making.

Prostate cancer screening is among several health behaviors (e.g., hormone replacement therapy) for which informed decision making or shared decision making is appropriate. Informed decision making takes place when the individuals understand the nature of the condition or disease being addressed; understand the potential consequences of the proposed decision including risks, limitations, benefits, and uncertainties; has considered his preferences; has participated in decision making at his desired level; and made a decision consistent with his values or decides to postpone a decision.[32] Support of informed decision making fits within the role constellation of the health educator though it may require rethinking to some degree of their usual practices. The research base for informed decision making would benefit from the contributions of health educators. Both professional reflection and research are needed to discern how best to

Table 3. Current PSA Test Use by Positive Lifestyle Health Behaviors

	%	χ^2	df	Probability
Lifestyle Behaviors				
Exercise other than work		110.31	1	0.0000
Yes	56.6			
No	45.4			
Smoking Status		80.43	2	0.0000
Current	41.5			
Former	57.7			
Never	55.0			
Drinks per session		40.60	2	0.0000
One or two	58.6			
Three or more	47.2			
None	51.0			
Seatbelt use		69.19	1	0.0000
Always	55.9			
At times or never	47.5			
Clinical Health Behaviors				
Sigmoidoscopy/colonoscopy		470.56	2	0.0000
Within past 5 years	70.5			
More than 5 years	50.5			
Never	41.1			
Blood stool test		394.55	2	0.0000
Within past 2 years	72.5			
More than 2 years	51.5			
Never	44.2			
Flu shot in past 12 months		521.58	1	0.0000
Yes	65.0			
No	44.0			

support individuals' involvement in informed decision making.

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Table 4. Adjusted Odds Ratios and 99% Confidence Intervals for Sociodemographic, Access, and Health Behaviors on PSA Use

	Odds Ratio	99% Confidence Interval	Probability
Socio-demographic and Access			
Age			0.000
50–59			
60–69	1.30	1.14 – 1.48	0.000
70 and above	1.24	1.08 – 1.43	0.000
Race/Ethnicity			0.014
Non-Hispanic White			
African American	1.24	.98 – 1.56	0.017
Hispanic	1.15	.84 – 1.57	0.252
Other, Non-Hispanic	0.81	.60 – 1.09	0.017
Education			0.0001
< High school			
High school graduate	1.25	1.02 – 1.52	0.004
> High school	1.37	1.13 – 1.66	0.000
Health Insurance	1.43	1.14 – 1.79	0.000
Source of Care	2.53	2.09 – 3.07	0.000
Lifestyle Behaviors			
Smoking Status			0.0003
Never Smoked			
Current Smoker	0.78	.66 – .92	0.000
Former Smoker	0.97	.86 – 1.10	0.558
Leisure physical activity	1.26	1.10 – 1.43	0.000
Seatbelt Use	1.18	1.05 – 1.33	0.000
Alcohol Consumption			0.0046
1 or 2 drinks			
3 or more drinks	0.93	.78 – 1.10	0.262
No drinks	0.86	.76 – .97	0.001
Clinical Behaviors			
Flu Shot	1.62	1.44 – 1.81	0.000
Colorectal Cancer Screening	2.93	2.62 – 3.26	0.000